

Appl. No. 10/747,718
Response dated December 7, 2006
Reply to Office Action of August 7, 2006

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Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-12. (Canceled)

13. (Currently Amended) A process for producing synthesis gas comprising:

passing a hydrocarbon containing gas and an oxygen containing gas over a partial oxidation catalyst, under conditions effective to produce a gas stream comprising hydrogen and carbon monoxide,

wherein the partial oxidation catalyst comprises a catalytic metal and a support material;

wherein the partial oxidation catalyst includes a plurality of discrete structures, each comprising a core containing said support material and an outer region disposed on said core;

wherein the plurality of discrete structures has an average size greater than 0.5 mm;
wherein the outer region has an thickness of not more than 200 microns, and further
wherein more than 60% of the catalytically active metal loaded on the discrete structure is located in the outer region

further wherein the catalyst comprises a substantially blocked-micropore layer disposed between the outer region and the center of the core, said substantially blocked-micropore layer being either at the periphery of the core or extended substantially throughout the core.

14. (Original) The process according to claim 13 wherein the catalytic metal comprises a Group VIII metal or noble metal.

15. (Original) The process according to claim 13 wherein the catalytic metal comprises rhodium.

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16. (Original) The process according to claim 15 wherein the catalytic metal comprises about 1 wt % or less of the total catalyst weight.
17. (Original) The process according to claim 15 wherein the catalytic metal comprises about 0.75wt % or less of the total catalyst weight.
18. (Original) The process according to claim 13 wherein 80% of the catalytic metal is located within the outer region.
19. (Original) The process according to claim 13 wherein the outer region thickness is no greater than 100 microns.
20. (Original) The process according to claim 13 wherein the support material comprises alumina.
21. (Original) The process according to claim 13 wherein the partial oxidation catalyst exhibits a methane conversion of greater than or equal to 80 mole %.
22. (Original) The process according to claim 13 wherein the partial oxidation catalyst exhibits a hydrogen selectivity of greater than or equal to 80 mole %.
23. (Original) The process according to claim 13 wherein the partial oxidation catalyst exhibits a carbon monoxide selectivity of greater than or equal to 80 mole %.
24. (Original) The process according to claim 13 wherein the hydrocarbon containing gas and an oxygen containing gas over the catalyst is done at a GHSV greater then 100, 000 hr⁻¹.
25. (Original) The process according to claim 13 wherein the hydrocarbon containing gas comprises methane.
- 27-29. (Canceled)
30. (Previously presented) The process according to claim 13 wherein 80% of the catalytic metal is located within the outer region.

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31-43. (Canceled)

44. (Previously presented) The process according to claim 13 wherein the catalytically active metal is iridium, rhenium, or rhodium.

45. (Previously presented) The process according to claim 44 wherein the catalytically active metal comprises about 1 wt % or less of the total catalyst weight.

46. (Previously presented) The process according to claim 44 wherein the catalytically active metal comprises about 0.75 wt % or less of the total catalyst weight.

47. (Previously presented) The process according to claim 44 wherein the catalytically active metal comprises about 0.5 wt % or less of the total catalyst weight.

48. (Previously presented) The process according to claim 15 wherein the catalyst further comprises a promoter selected from the group consisting of lanthanide metals, rhenium, zirconium, and combinations thereof.

49. (Previously presented) The process according to claim 15 wherein the catalyst further comprises a promoter selected from the group consisting of rhenium, zirconium, and combinations thereof.

50. (Previously presented) The process according to claim 15 wherein the catalytic metal comprises about 0.5 wt % or less of the total catalyst weight.

51. (Previously presented) The process according to claim 13 wherein the outer region is delimited by the exterior surface of the catalyst structure; the core comprises the center of the structure; and wherein the catalyst comprises a gradient in catalytically active metal concentration with the highest concentration near said exterior surface and essentially zero near said center.

52. (Previously presented) The process according to claim 13 wherein the outer region comprises rhodium and a promoter selected from samarium, rhenium, zirconium, and combinations thereof.

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53. (Previously presented) The process according to claim 13 wherein the catalyst further comprises a promoter, and more than 60% of the promoter loaded on the discrete structure is located in the outer region.

54. (Previously presented) The process according to claim 13 wherein more than 80% of the catalytic metal is located within the outer region.

55. (Previously presented) The process according to claim 13 wherein the outer region is a catalytic outer layer greater than 0.5 micron thick.

56. (Canceled)

57. (Previously presented) The process according to claim 56 wherein the catalyst further comprises a substantially blocked-micropore layer disposed at the periphery of the core.

58. (Previously presented) The process according to claim 56 wherein the substantially blocked-micropore layer is created before the loading of the catalytically active metal by a method comprising applying silicic acid or sodium carbonate to the support material and then calcining.

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59. (Currently amended) A process for producing synthesis gas comprising:
passing a hydrocarbon containing gas and an oxygen containing gas over a partial
oxidation catalyst under conditions effective to produce a gas stream comprising
hydrogen and carbon monoxide.
wherein the partial oxidation catalyst comprises a catalytic metal and a support
material;
wherein the partial oxidation catalyst includes a plurality of discrete structures, each
comprising a core containing said support material and an outer region disposed on said
core;
wherein the plurality of discrete structures has an average size greater than 0.5 mm;
wherein the outer region has a thickness of not more than 200 microns,
wherein more than 60% of the catalytically active metal loaded on the discrete
structure is located in the outer region, and further
wherein the core is nonmicroporous.
60. (Previously presented) The process according to claim 59 wherein the nonmicroporous core is created before the loading of the catalytically active metal by applying a pore blocking material to the support material and then calcining, said pore blocking material being selected from the group consisting of silicic acid and sodium carbonate.
61. (Previously presented) The process according to claim 13 wherein the discrete structures are particles with a trilobe configuration.
62. (Previously presented) The process according to claim 13 wherein the discrete structures are particles with a spherical configuration.
63. (Previously presented) The process according to claim 13 wherein the discrete structures are particles having a size greater than about 1 mm.
64. (Previously presented) The process according to claim 13 wherein the support material comprises a refractory material selected from the group consisting of alumina, titania, zirconia, gallium oxide (Ga_2O_3), silica and mixtures thereof.

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65. (Previously presented) The process according to claim 13 wherein the oxygen containing gas comprises air, oxygen-enriched air, oxygen blended with a diluent gas, or substantially pure oxygen.
66. (Previously presented) The process according to claim 13 wherein the hydrocarbon containing gas comprises natural gas.
67. (Previously presented) The process according to claim 13 wherein the partial oxidation catalyst exhibits a hydrogen selectivity of greater than or equal to 85 mole %.
68. (Previously presented) The process according to claim 13 wherein the partial oxidation catalyst exhibits a carbon monoxide selectivity of greater than or equal to 85 mole %.
69. (Previously presented) The process according to claim 13 wherein the partial oxidation catalyst exhibits a methane conversion of greater than or equal to 85 mole %.
70. (Previously presented) The process according to claim 13 wherein the gas stream comprising hydrogen and carbon monoxide is further reacted in a hydrocarbon synthesis reactor under conditions effective to produce liquid hydrocarbons.